MACHINE DESIGN.

Elements of Machine Design. By Dr. S. Kimball and J. H. Barr. Pp. viii+446. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1909.) Price 12*s*. 6*d*. net.

THIS is an important work on a subject which it is difficult to treat in systematic manner on account of the great complexity of the conditions involved. The variety of machines now made is almost overwhelming, and is continually increasing, while for the successful and intelligent design of machines of any one class the engineer must possess a faculty of invention, a sound judgment, some acquaintance with commercial conditions, familiarity with workshop processes, a knowledge of the many branches of applied mechanics and of physics, all the result of long study and practical experience. The treatment of so extensive a subject must of necessity be only partial, and the primary appeal of this book is to students of technical colleges. At the same time, the expert draughtsman will find much of interest and profit. The drawings are subordinate, and are introduced mainly to illustrate principles. The treatment is logical yet practical, very suggestive and germane to the subject, and the style is attractive and interesting. The writers can speak with authority, each having had experience as a professor of Sibley College, Cornell University, and also as a manager of an engineering works.

The authors begin with some examples illustrating the energy changes which take place in a machine during a cycle of operations, the object of the investigation being to determine the maximum value and range of the force actions which occur. Then follows an explanation of how the parts are to be designed so as to withstand successfully these straining actions, and a very complete and well-arranged collection of formulæ for the strength and stiffness of beams, shafts, struts, &c., is given. The discussion of the considerations which affect the choice of a suitable factor of safety will here be found very helpful.

The chapter on friction, lubrication, and efficiency is extremely interesting and suggestive. The investigations on lubrication by Beauchamp Tower and later experimentalists are quoted and analysed, and their significance explained. Subsequent chapters are devoted to machine details, comprising springs, riveted joints, screws and bolts, keys and cotters, tubes and pipes, constraining surfaces for sliding and turning motions, shafting and couplings, belt, rope, and chain transmission, friction wheels and brakes, spur, bevel and screw gears, flywheels, pulleys and rotating discs, and, lastly, machine frames.

The chapter on constraining surfaces is one of the best in the book. Some of its drawings exhibit modern types of cylindrical and thrust bearings, and ball and roller bearings. In the general discussion the authors enter fully into the permissible bearing pressures, the details for securing efficient lubrication, the dissipation of heat from the bearing, and all the conditions for successful design. Indeed, every chapter is suggestive and interesting, but enough has been said to indicate the general character and scope of the work. We must, however, not overlook the numerical examples which are introduced at intervals, and used to illustrate and suggest the proper treatment of problems in design. Mention should also be made of the many references to publications, to assist readers who desire further information.

Altogether, the authors are to be congratulated on the production of a very instructive, well-arranged, and well-written treatise on the elements and principles of machine design. The book should be in the library of every engineering school and college.

THE ATRIUM OF SOUTH AFRICA.

An Introduction to the Geology of Cape Colony. By Dr. A. W. Rogers and A. L. Du Toit. Second Edition. Pp. xiv+492. (London: Longmans, Green and Co., 1909.) Price 9*s*. net.

THIS handbook is the second edition of that reviewed in 1905, and the progress made since then in South African geology renders its appearance all the more welcome. Dr. Rogers has associated his colleague, Mr. Du Toit, in the authorship, and the preparation of the new material has no doubt raised pleasant memories of many a long campaign, in lands where the horizon always seems to call one further, until the rim of the world sweeps up against the sunset, and another night is spent beneath the stars.

The complete revision of the work makes it virtually a new one for purposes of reference; and the coloured map is now on a larger scale, and covers additional ground, notably in Griqualand West. Two sections illustrate the folded margins of the colony, and the broad synclinal of the Karroo system, which in places measures 450 miles from side to side. The correlation of the pre-Devonian rocks (p. 5) is considered in some detail, and reasons are given (p. 110) for the retention in this group of the "continental" Matsap system on the fringe of the Kalahari. The Karroo system, from the Lower Dwyka beds to the volcanic capping of the Drakensbergen, is compared (p. 233) with South American and European strata, on the basis of recent literature. The glacial Dwyka beds, composed of the so-called "tillite," may be Upper Carboniferous or Lower Permian; but the reptilian fauna places the Upper Dwyka series in the Permian. The Beaufort beds, with Pareiasaurus, Oudenodon, and the freshwater molluscs Palæomutela and Palæanodonta, are paralleled by the Russian Permian. The Upper Beaufort or Burghersdorp series is, however, probably Triassic; so also are the succeeding Molteno beds, regarded as equivalents of the Rhætic. The Stormberg series, if we except the Molteno beds, is held to be Jurassic. Dr. Broom has entirely re-written his chapter on the Karroo reptiles, and points out that Tritylodon, which he has elsewhere shown to be most probably a Jurassic form, may be retained among the mammals.

The chapter on the volcanic pipes younger than the volcanic Stormberg series has been expanded, but no longer contains the sections of the rock-shafts at Kimberley. The relationship of their igneous infilling, known as kimberlite, to melilite-basalt (p. 364)

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is emphasised by new evidence from North America, in addition to that known from Cape Colony. A brilliant suggestion of Carvill Lewis becomes thus fully justified.

In the fine chapter on the geological history of the colony, the influence of Prof. W. M. Davis (p. 451) now becomes justly manifest. There was little to modify, however, in Dr. Rogers's original review of the great processes that have made South Africa. His suggestion that the S-bends of the rocky gorges in the south are the descendants of meanders formed when the rivers ran over a great plain remains happily unaltered. If South African geologists have learnt willingly from friends whom they invited in 1905 to the coast-ranges and the veld, it will be long before those friends can repay what they themselves received. The guidance then given by Dr. Rogers is renewed and extended in the present admirable volume.

G. A. J. C.

OUR BOOK SHELF.

The Romance of Modern Chemistry. By Dr. J. C. Philip. Pp. 348. (London: Seeley and Co., Ltd., 1910.) Price 5*s*.

ACCORDING to its subtitle, this book is "a description in non-technical language of the diverse and wonderful ways in which chemical forces are at work, and of their manifold application in modern life." After some prefatory historical and theoretical matter, the reader is provided with a wealth of brightly-written and interesting information about fuel and its uses, explosives, low-temperature and high-temperature appliances, and spectroscopy. Modern phases of agricultural chemistry and of industries relating to sugar, starch, fats, and oils are discussed, and the concluding chapters give well-chosen illustrations of applied chemical science in relation to the adulteration of food, the utilisation of by-products, coal-tar products, large-scale electrolysis, solutions, crystals, and industrial catalysis. The last chapter illustrates vividly the part that "accident" has played in chemical discovery.

The most formidable difficulty in writing a book of this kind is to get the reader sufficiently acquainted with the elements of chemical fact and reasoning to enable him to understand the applications. Dr. Philip has adopted a light treatment and allowed himself a free use of imagery of an anthropomorphic kind, which will probably make an impression. To a reader who knows just a little chemistry the interest from the beginning of chapter vi. to the end of the book (chapter xxx.) will be kept fully alive, and as the body of information contained in these chapters is just that which is apt to be omitted from school or evening-class courses of formal chemistry, the book has a very distinct place of usefulness. It is written with an unimpeachable knowledge of scientific chemistry, a very unacademic appreciation and knowledge of practical problems, and a certain amount of human nature, which make the best possible equipment for the author of a book intended to popularise science. The chapter on solutions is particularly worthy of mention as an example of admirable exposition. There are twenty-nine excellent illustrations, which have been selected with care and at considerable trouble, but a long accumulating detestation of the very names stalactite and stalagmite would have reconciled the present writer to a suppression of the three plates dealing with these bedridden natural and etymological phenomena.

A. S.

Hayward's Botanist's Pocket-book. 13th edition. revised and enlarged. By G. C. Druce. Pp. xliv+280. (London: George Bell and Sons, 1909.) Price 4*s*. 6*d*. net.

THE "Botanist's Pocket-book" is well known as a handy companion of a convenient size for the pocket, and containing sufficient data to determine ordinary plants in the field. The original work, published in 1872, was enlarged in 1886 by the addition of an appendix, but, as many changes have recently been rendered necessary, the publishers have wisely authorised Mr. G. C. Druce to make a thorough revision. The general plan remains the same, but there is evidence of Mr. Druce's emendations from the first page to the last. Notably, the synopsis of the natural orders has been corrected, the arrangement of the genera has been altered, and both genera and species have been carefully revised to incorporate the conclusions of present-day authorities and present the nomenclature in accordance with the recommendations of the Vienna Congress.

The revision gives all species and varieties, even certain hybrids, except for the genera Hieracium, Euphrasia, and Rubus. Although the identification of many critical species and varieties will not be decided in the field or even on the scanty data supplied, botanists will not cavil at the decision to include them, especially as it has not necessitated an increase in the size of the volume. It is not apparent why the family names Lamiaceæ and Graminaceæ have been coined, while the substitution of Pinaceæ for Coniferæ to include Taxus cannot be accepted; further, it would have been less perplexing to many botanists to find the nomenclature if not the sequence of the last edition of Babington's "Manual." Doubtless the last point has received the consideration of the reviser, who has rendered another service to botany by placing on record his conceptions based on many years' constant study of British plants.

Yorkshire Type Ammonites. Edited by Mr. S. S. Buckman. Part I. Pp. i–xii, *i–ii*, plates 12, and descriptions Nos. 1–8. (London: W. Wesley and Son, 1909.) Price 3*s*. 3*d*. net.

IT is intended that this work shall appear in about sixteen parts. The object of the publication is to give an adequate pictorial and critical revision of the type-specimens of Jurassic ammonites from Yorkshire which were unsatisfactorily described or figured by the early authorities Young and Bird, John Phillips and Martin Simpson. The treatment is similar to that in the well-known "Palæontologia Universalis," and the excellent illustrations in collotype process are from photographs of the actual specimens, mainly by Mr. J. W. Tutcher. In addition to a reprint of the original diagnoses, supplemented by useful critical remarks, the editor has supplied a clearly arranged and concise account of the comprehensive system of terminology which has been adopted by those who have made the most advanced studies of ammonite-development. He has also added some original and suggestive remarks on the cyclical development of the shell-form. In another section of the work there are useful notes on generic names. Twelve plates are issued in the present part, with text relating to eight species, and the introductory matter is uncompleted. This work will prove indispensable, not only to those who take a serious interest in Yorkshire geology, but to all students of Jurassic ammonites.

Klimatographie von Österreich. Part IV. *Tirol und Vorarlberg.* By Dr. H. v. Ficker. Pp. vi+162. (Vienna: Gerold und Komp, 1909.)

THIS volume forms part iv. of the valuable handbook on the climatology of Austria which is being issued by

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